

problems. The study of anatomy was at one time paramount. This was followed by the study of the functions of body structure, the science of physiology, while the changes in physiological function became the study of pathology. A better understanding of pathology, assisted by the advancing knowledge of chemistry as applied to treatment, was responsible for the study of pharmacology—the precise effect of drugs upon the human economy. The interest in chemistry led to a new discipline—the chemistry of human metabolism, biochemistry—in which the minute and complex changes which occur in the tissues, the blood-stream, and organs of our complicated human mechanism are critically investigated. Microbiology has made striking advances, particularly in the study of virology. Allergy

has had its phase, and now autoimmunity is in the limelight. But none of these disciplines can be allowed to supersede or replace the art of clinical medicine as practised at the bedside of the patient of whatever age.

It has been said that old men dream dreams and young men see visions. I hope I am young enough to see the prospect of a wonderful future for paediatrics in the next 40 years.

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Snuff—Its Use and Abuse

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Brit. med. J., 1964, 2, 1649–1651

When they talk'd of their Raphaels, Correggios, and stuff,
 He [Reynolds] shifted his trumpet, and only took snuff.

Oliver Goldsmith.

Sneezing is not only the most effective way of cleansing the nose—it has for countless generations enjoyed an important place in mythology and religious dogma throughout the world.

Substances which when deliberately introduced into the nose produce this “beneficial” and happy reflex action are termed sternutatories or snuffs, and have been employed for medicinal purposes since the time of Hippocrates. In this modern age, however, most snuffs contain finely ground tobacco, and, although avidly consumed by “dippers and snuffers,” convey no beneficial properties—except perhaps to the Inland Revenue.

A Frenchman, André Thevet, first introduced tobacco into France from Brazil in 1556. Jean Nicot, French Ambassador to Sebastian, King of Portugal, reintroduced it in the form of snuff in 1559, as a cure for migraine. The generic name *Nicotiana* is derived from Nicot's surname and has been in use since 1570 (Watt, 1953).

All too rapidly, however, the stimulating properties of the tobacco led to widespread habit-formation, and by the end of the century it was the commonest form of social addiction in France.

Curiously enough, snuff became popular in Britain only at the time of the Great Plague (1665), when it acquired the reputation of a powerful prophylactic—as well as being efficacious against unpleasant smells! The Scots accepted this new habit so enthusiastically, and consumed such large quantities, that the effigy of a Highlander has signposted snuff-shops ever since (Fig. 1). By the end of the seventeenth century snuffing had become an essential part of the fashionable way of life, but the great period of snuff-taking in Britain came during the reign of George III and his wife Charlotte (1760–1820). The Queen was so addicted that she received the nickname “Snuffy Charlotte”; but most of the great personages of this period, male or female, doctor or dandy, were devotees. Lord Nelson, the Duke of Wellington, Marie Antoinette, Napoleon, Disraeli, Pope, and the famous Dr. Samuel Johnson all refreshed themselves with a pinch of snuff—usually taken from a beautifully decorated and often valuable snuff-box (Fig. 2). It is recorded that the only medicine that Dean Swift took

for his Menière's symptoms was “some herb snuff prescribed by Dr. Radcliffe,” an eminent physician (Wilson, 1957).

The vogue continued until the middle of the nineteenth century, gradually being replaced by other and more lethal forms of tobacco addiction. Since the last war there has been definite evidence of a revival, and the United States Department of Agriculture estimated that 34,000,000 lb. (15,422,100 kg.) of snuff was sold in 1961, almost all within America, with Tennessee possessing the dubious honour of being both the leading producer and the leading consumer (Rosenfeld and Callaway, 1963). In London snuff-shops still exist which offer over 50 different blends, and the mills of Sheffield and Kendal produce and export considerable quantities to all parts of the world.

Preparation

Details of the techniques employed in the manufacture of snuff are closely kept secrets, but in this country it is usually blended from finely ground tobacco leaf and stalk which has previously been fermented in a salt solution and subsequently “cured.” It is then ground and perfumed, but the real skill lies in the blending.

Oriental snuff, consumed in countries such as Thailand, differs considerably both in preparation and in constituents from that popular in the Western World. Its composition is approximately 50% dry tobacco and 50% Oriental gum, with a small amount of powdered cuttlebone added. The gum is made by heating “white earth” at high temperatures in a kiln,



FIG. 1.—Wooden effigy of a Highlander.

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and contains considerable amounts of calcium carbonate and phosphate. After adding water the gum paste is mixed with tobacco and allowed to dry in the sun. This final product, a dry tan powder, is taken in small doses with the aid of a U-shaped metal tube. One end of the tube is placed in the nose and the other end in the mouth. A blast of air from the mouth disperses the powder into the nasal cavity, from which it is inspired similar to tobacco smoke (Chinachoti and Tangchai, 1957).

Snuff-taking among the South African Bantu is in most tribes a universal habit and plays an important part in all tribal ceremonies and customs. Tobacco is never the sole

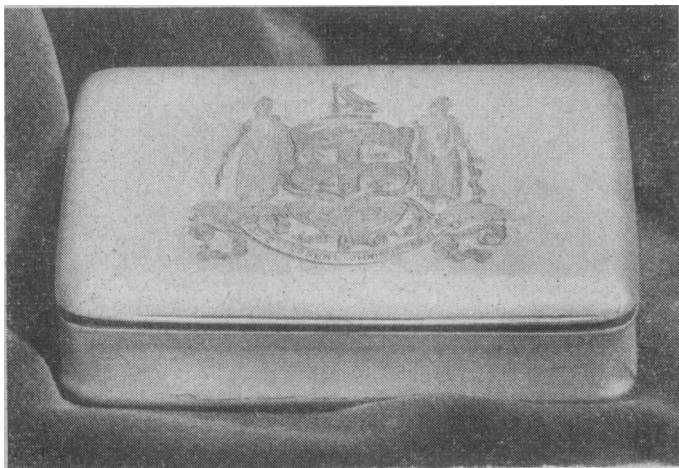


FIG. 2.—A George III snuff-box dated 1790. (Reproduced by courtesy of the Royal College of Surgeons, England.)

constituent of the snuff, being regarded as insufficiently potent, and admixtures of various incinerated plants or herbs are used. There are over 20 plants in common use, the favourite being the aloe (Keen *et al.*, 1955). After burning the dried plants the ash is ground and then mixed with a little water together with flavouring agents such as lemon juice or eucalyptus oil. The tobacco powder is mixed with the ash, forming a highly irritant snuff. Cooper (1955) analysed samples of Bantu snuff and found not only nicotine but polycyclic hydrocarbons, including the carcinogen 3:4-benzpyrene. Heavy cigarette-smoking among the Bantu is uncommon and carcinoma of the lung is infrequent. However, there is an extremely high incidence of carcinoma of the maxillary sinus and the possible association between this and snuff-taking is discussed below.

Snuffing and Dipping

In Britain the powder is invariably inhaled, although the precise method employed may vary from individual to individual. Some will transfer a pinch direct from snuff-box to nostril, while others use a silver spoon to convey it from the back of the hand to the nostril. The President of the Society of Snuff Grinders, Blenders and Purveyors still prints on his boxes a list of the 12 operations which in 1857 were described as "the true artistic method"; and it is still permissible to take snuff—but not smoke—in the Houses of Parliament. Nicotine is found in most species of the tobacco plant, the content increasing from the stock to the tip of the leaf; and if tobacco be brought in contact with tissues, as in snuffing or dipping, then there will be absorption of this extremely lethal substance. Fatal poisonings from snuffing have been reported (Webster, 1930), including the accidental swallowing of 0.8 g. of snuff (Webster, 1930) and the deliberate administration of snuff in porter and other liquors (Smith, 1928). The poet Santeul is said to have died from the effects of snuff put into his wine at the dinner-table of the Prince of Condé (Wirthaus and Becker, 1911).

The most popular method of use in the United States, and more especially the North Central and North-Western States, is to place a liberal pinch of the powder between the gingiva and the lower lip or buccal area. This technique is also popular in the Xosa and Fingo tribes of South Africa. Snuff "dipping," as this technique is known, is especially favoured by women, and seems to be both economical and particularly habit-forming. Habitual users begin about the age of 20 years and will have enjoyed the pleasures of the habit for some 40 years before suffering the sequelae of their folly. Reports by Moore *et al.* (1952), Wilkins and Vogler (1957), and Vogler *et al.* (1962) all show a high incidence of buccal carcinoma in snuff-dippers. Rosenfeld and Callaway (1963) found that 90% of all female patients with neoplasms in the alveolar buccal sulcus were habitual dippers and usually developed the carcinomata at the site of the "quid." Numerous aetiological factors have been related to the development of buccal carcinoma, and reports from India have shown that the incidence increases considerably when tobacco is included in the betel-nut quid, although in New Britain and New Guinea, where the natives chew betel nut without tobacco, the incidence of buccal carcinoma is relatively low (Landy and White, 1961).

The exact chemical substance present in the snuff used for dipping in the United States has not as yet been isolated, but clinical studies have indicated that a carcinogenic agent is present which will induce malignancy after prolonged exposure.

Snuff and Carcinoma of the Maxillary Sinus

Shapiro *et al.* (1955) published an analysis of all patients referred to the Radiotherapy Department of the Johannesburg Group of Hospitals with carcinoma during the years 1949–51. Of these cases 6.9% had neoplasms of the respiratory system.

The incidence of lung cancer in the European patients was 5% of all malignant cases referred, but the corresponding figure for the Bantu was only 0.5%. This is explained by the variation in the quantity of cigarettes consumed by the two races.

In marked contrast to lung cancer, however, tumours of the paranasal sinuses accounted for almost 6% of the Bantu malignant cases but for only 0.2% of all cancer in the United States (May, 1949). These figures indicated a true incidence of carcinoma of the paranasal sinuses (the majority occurred in the maxillary sinus) between 10 and 20 times greater than in the European. It is important to note that the incidence of maxillary-sinus cancer in other pigmented people is not significantly greater than in the European (Khanolkar, 1951). Unlike the racial differences of incidence seen in carcinoma of the lung and maxillary antrum, neoplasms of the nasopharynx formed 10% of the respiratory malignant diseases seen in Europeans and 8% of those occurring in the Bantu.

The use of indigenous snuffs is widespread among the Bantu and 80% of the patients with antral carcinoma admitted to prolonged usage of snuff—a figure thought by the investigators to be a conservative estimate. The presence of the carcinogen 3:4-benzpyrene in samples of Zulu snuff has already been commented upon, and that might well account for the extremely high incidence of carcinoma of the maxillary sinus found in these people.

Before postulating a theory to explain the relation between snuffing and the development of sinus carcinoma, it is necessary to consider the broad features of normal nasal physiology.

The stream of inspired air does not pursue a straight course from anterior nares to choana but passes in a wide curve beginning at the nostril, extending through the olfactory fissure, and ending in the choana (Proetz, 1941).

The ostium of the maxillary sinus is protected from this inspiratory air stream lying high up in the middle meatus, and experimental evidence has shown that if this ostium be patent then the negative pressure produced in the nose on inspiration,

reaching a maximum figure of 55 mm. of mercury, is virtually identical with that produced in the maxillary sinus. However, this merely serves to remove any small plugs of mucus occluding the ostia, and air fluctuations through the ostia are rarely of sufficient force or magnitude to carry foreign particles into the sinuses.

Anatomical studies of the maxillary ostium (Myerson, 1932) showed that this is not a flat opening but a tube of some depth, the axis of which may be angulated as much as 40 degrees. Furthermore, in 20% of specimens the opening is directly inaccessible from the nose unless the overhanging middle turbinal or ethmoidal bulla be removed.

During sniffing, air is projected against the nasal mucosa and the anterior portion of the nose, producing eddies, and it is extremely unlikely that any of the large particles found in inspired snuff could pass both the anatomical and the ciliary defence barriers to enter the ostium of the maxillary sinus.

Clinical Inquiry

Unfortunately it proved impossible to examine the nasal cavities of any snuff addicts among the Bantu race. However, 22 patients from Britain who had used indigenous commercial snuff for at least twenty years agreed to examination and also to sniff pinches of finely ground barium sulphate powder. The average particle size of this substance is 20 μ , approximately the same as that found in commercial snuff, and the object of the procedure was to determine the possibility of introducing these particles through the ostium of the maxillary sinus by the simple process of repeated sniffing. Examination of the nasal passages of these snuff addicts revealed a generalized atrophy of the mucosa, and biopsy in four patients confirmed metaplasia of the ciliated columnar epithelium to squamous epithelium over the middle turbinal and adjoining nasal septum. The middle meatus was clearly seen and contained quantities of coalesced snuff, as did the nasal vestibule and anterior portion of the septum. After careful cleansing of the nose the man (I have not succeeded in identifying a woman snuff addict as yet) sniffed pinches of barium sulphate powder up one nostril, and inspection revealed that the white powder collected primarily in the middle meatus in every case.

In no case was it possible to show radiologically that opaque barium sulphate powder had passed into the maxillary sinus. However, it was obvious that in the snuff habitué the coalesced particles of tobacco collected in the greatly enlarged middle meatus, and because of the loss of cilia it might be expected that these particles would remain *in situ* until removed by nose-blowing or sneezing.

Repeated sniffing of relatively large particles (20 μ) of irritant tobacco and plant ash by the Bantu will lead to eddying and deposition of snuff in the anterior portion of the nose. There is at first hypertrophy and then atrophy of the nasal mucous membrane, and it is at this latter stage that the beginner ceases to sneeze and becomes habituated.

As a result of these changes the mucosa covering the middle and inferior turbinates becomes atrophied and the middle meatus consequently enlarged, permitting coalesced masses of snuff to enter. Eventually the carcinogenic properties of this potent snuff exert their effect, producing neoplasia in the region of the ostium. When the Bantu eventually seeks medical help

the cancer is invariably extensive and the original site of origin impossible to determine, thus accounting for the frequency with which such lesions are labelled "sinus carcinoma."

Cilia remaining on the posterior part of the nose are unable to transport the relatively large particles (over 10 μ) of snuff back to the nasopharynx, and consequently the incidence of nasopharyngeal carcinoma remains much the same in the Bantu as in the European.

It is probable that any race of people addicted to snuff containing one or more carcinogens would show an excessively high incidence of sinus neoplasia. The commercial preparations available in this country, however, appear to be free from this risk, and it may well be that, if tobacco addiction is unavoidable, snuffing is preferable to smoking.

Summary

Snuff has been used in this country for about three hundred and fifty years, achieving its greatest popularity during the eighteenth century. Although methods of preparation remain closely kept secrets a brief account is given of the techniques employed in the Far East and by the Bantu. The powder may be "snuffed" or "dipped" and the various effects produced by these forms of tobacco addiction are discussed together with a possible explanation for the association between snuffing and carcinoma of the maxillary antrum in the Bantu.

Clinical investigation of twenty-two snuff addicts in Great Britain reveals constant changes in the nasal airways, but commercial snuff is apparently free from carcinogenic activity.

Without the assistance and encouragement of both patients and friends (all admitted snuffers) this paper would never have been thought of, let alone written. I should also like to express my appreciation to Dr. J. V. Dadswell, of the Department of Pathology, Institute of Laryngology and Otology, for his expert advice and measurements of particle size.

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